

INFORMATION REPORT INFORMATION REPORT

CENTRAL INTELLIGENCE AGENCY

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COUNTRY USSR

REPORT

SUBJECT Electronic Equipment used in Sputniks I, II, and III

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A report and two sketches on electronic equipment used in Sputniks I, II, and III

The sketches contain signals portraying the passage of Sputnik I. The report contains information on the operating frequencies, amplitudes, and transmitters used in Sputnik I; the operating frequencies, types of modulation, control signals, telemetering channels, and transmitters used in Sputnik II; and the operating frequencies, types of modulation, telemetering channels, and solar batteries used in Sputnik III.

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USSR - Information concerning Sputnik-I, Sputnik-II, and Sputnik-III.

*ATTACHMENT*1. Frequencies of the broadcasts from Sputnik I

The operating frequencies of the two transmitters of Sputnik I were:

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a) 20.005 megacycles;

b) officially, 40.005 megacycles; more probably,

40.010 megacycles.

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2. Oscillographic presentation of the signals from Sputnik I

see enclosure.

3. Variation limits of the amplitudes of the pulses or frequencies.

The amplitude of the pulses varied between a maximum and a minimum, diverging from zero, probably due to the "backwave" of the keying, with an excursion of 14-16 decibels. The frequency of repetition of the pulses varied between 120 and 180 words per minute, with average time duration of 0.19 seconds on and 0.23 seconds off.

The signals received were of three types, at least:

a) pure CW, rhythmically interrupted (fig. 1 of the enclosure).

b) rapidly variable amplitude of the pulse.

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(fig. 2 of the enclosure).

- c) amplitude of the slightly variable pulses with periods ranging between 4.3 and 4.6 seconds, and sometimes greater (up to 8 seconds). The period of such variation was constant during each passage, but it changed from passage to passage. The amount of relative modulation did not exceed 30%. The variation was not attributable to qsb; this, in fact, had a somewhat similar effect on the WWV, contiguous to the Sputnik.

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4. Frequencies and type of modulation of the Sputnik II.

The frequencies were [] the official ones of 20.005 and 40.005 megacycles. Concerning the latter, a Doppler effect was clearly observable;

[] the frequency of 40 megacycles was chosen by the Soviets as it represented a compromise between the extent of the Doppler effect and immunity from other interferences. By means of the aforementioned effect, the Soviets have verified the orbit information. The Sputnik II emitted two types of signals, namely:

- a) FM multiplex;
- b) pulses.

The information was transmitted with programming and limited to the Eastern Hemisphere. It is doubtful that an interrogator was used.

5. Limits of deviation in the amplitudes of the pulses; pulse positions.

Various types of signals were observed, which differed greatly []

- a) MCW (tone), about 400 cycles and continuous for about 20 minutes.
- b) pulses with frequency of repetition of 132 words per minute, constant spacing, and variable amplitude within a maximum excursion of 6 decibels.

c) CW, continuous for 11 minutes []

d) AM (tone), described as "fuzzy" []

The broadcasting on 40 megacycles began at ^{0610 hours} 6:10 []

6. Frequencies and type of modulation of the Sputnik III transmitters.

The frequencies of the Sputnik III were also 20.005 and 40.005 megacycles; some Soviet scientific publications also speak, however, of a broadcast on 75 megacycles; this might concern the fact that there is a waveband reserved for Soviet amateur radio operators.

SECRET

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The signals on 40.005 megacycles were of various types; the following were observed:

- a) pure CW, continuous for 3-5 minutes.
- b) pulses, with frequency of repetition of about 150 words per minute, spacing, and variable amplitude.
- c) FM multiplex, with deviation of 25 megacycles.

7. Telemetering channels of the Sputnik II

The Sputnik II did not have more than 8 channels. The radiological instrumentation permitted only the total measurement of the incident radiation, but not its analysis in energy.

8. Telemetering channels of the Sputnik III

The electronic instrumentation of the Sputnik III consisted of a transistorized programmer (Pravda) with thousands of semiconductors (probably ferrite memory elements).

9. Frequency for the interrogation (?) of the Sputniks

One frequency for Sputnik II was 14.286 megacycles. It is not clear whether this signal of control, or guidance, served for interrogation (not very likely), or whether it was only a signal of control, or guidance, used in the phase of placing the satellite in orbit.

10. Modulation of the frequency for the interrogation of the Sputniks

This signal [] was of the MCW type, with beat frequency of about 800 mcycles, and with pulses sent in groups of 5 or 7 units, very similar to fsk.

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11. Recording systems for the information transmitted

[] the system was magnetic with video-tap.

50X1-HUM

- 3 -

SECRET

50X1-HUM

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12. Description of the transmitters used in the Sputniks

Both Sputnik I and Sputnik II were equipped with two antenna systems, serving two transmitters. In both cases, this concerned Marconi 2 x 4 semidipoles, jointed and folded, fed through adaptors of the Gamma type-- that is, a T-junction. The transmitters of Sputnik I had a radio frequency capacity of about 10 watts, as shown by the Komsomol, Pravda, and by a theoretical calculation [redacted]. The transmitters of Sputnik II, on the other hand, had a much smaller capacity, which was estimated, on the basis of the characteristics of the solar batteries, and also from the description appearing in the aforementioned magazine, at about 350-500 milliwatts.

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13. Solar batteries used in the Sputniks

The solar batteries of Sputnik III consisted of 9 elements (statements of Varaskin at Geneva), ⁴ of which were mounted on the anterior part, 4 on the posterior part, and one (split into more elements) on the side. Each element produced 0.5 volts, with an output efficiency of about 15%. The Soviet tendency concerning solar batteries and rockets is to use the following materials: arsenide of gallium, phosph^{ide} of indium, telluride of cadmium, antimonide of ^{al}uminum, and selenide of cadmium.

Also attached is a copy of the recording of the passage of Sputnik I,

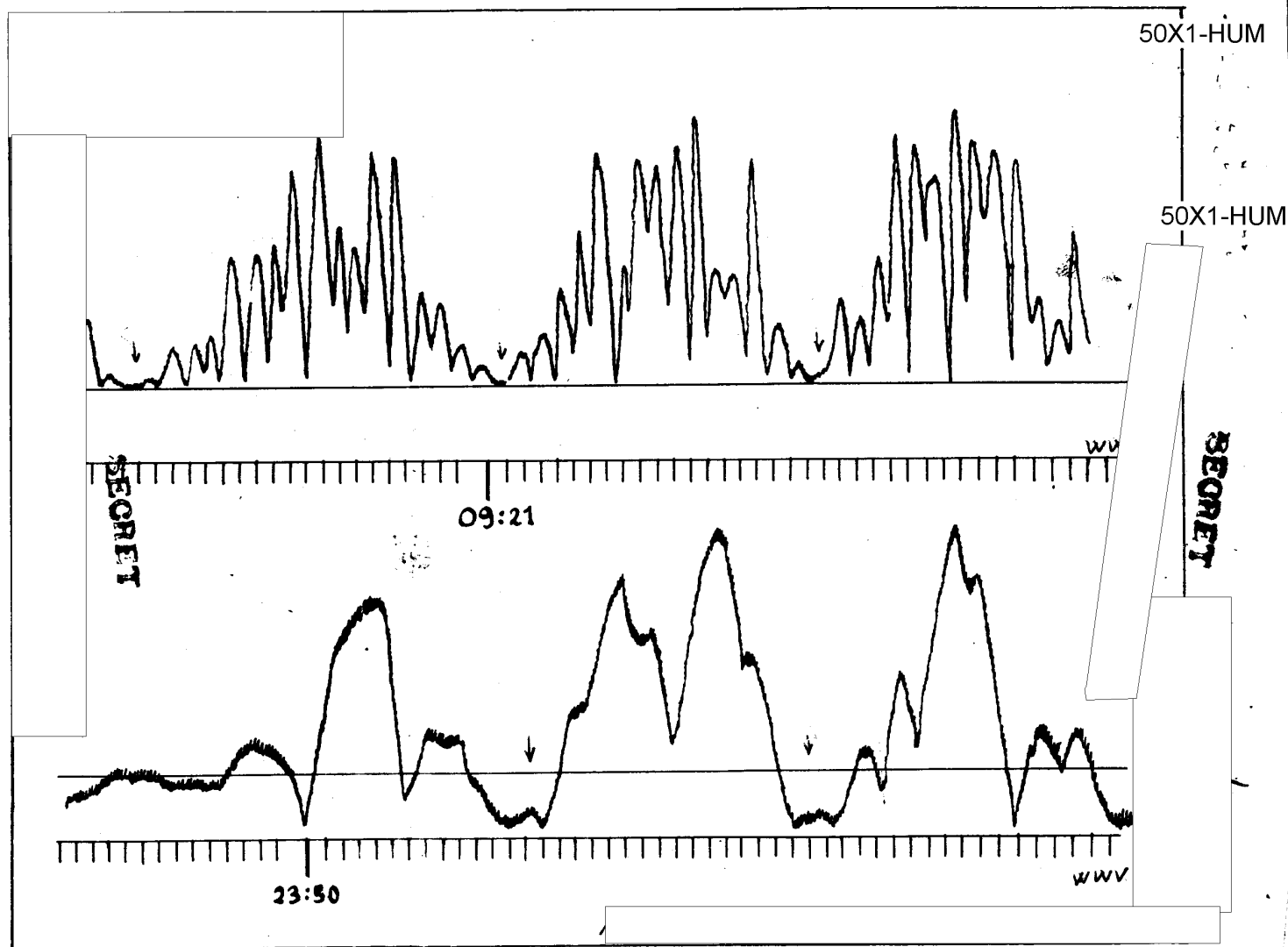
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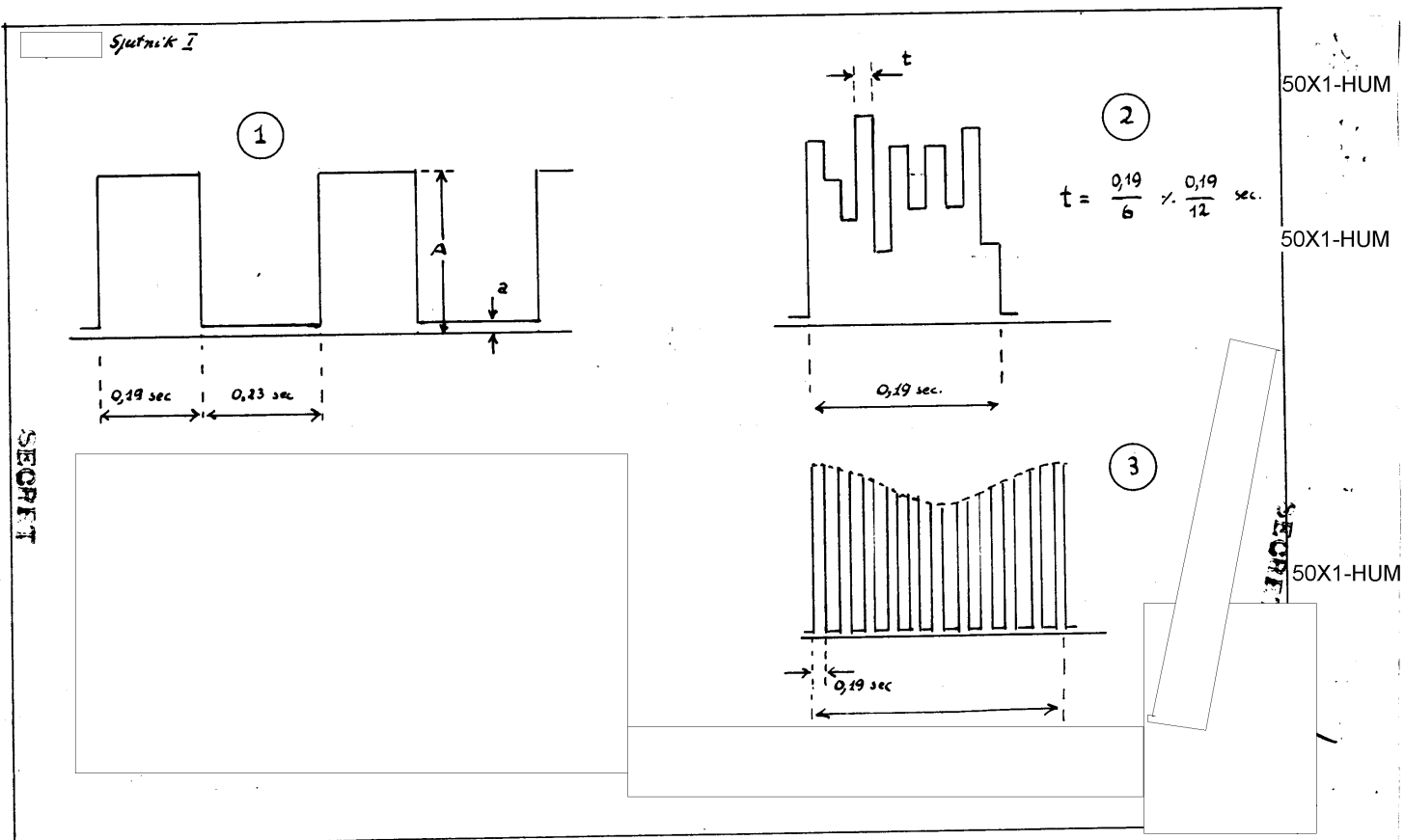
- 4 -

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